# REMARKS

## I. Pending Claims

Claims 1-6 and 9-19 are pending in this application. Claims 1, 2 and 6 are independent. Claims 1-2, 6, 12, 14, and 19 are currently amended.

Claims 1 and 2 are objected to because the term "measured voltage" recited therein allegedly lacks antecedent basis.

Claims 12, 14-17, and 19 stand rejected under 35 USC 112, second paragraph, for allegedly not particularly pointing out and distinctly claiming the subject matter which the Applicant regards as the invention, as follows:

Claim 12 recites the limitation "second battery full-capacity calculator unit" in line 2. There is insufficient antecedent basis for this limitation in the claim. Notably, claim 12 is dependent upon claim 4, not claim 11 (which has a first battery full-capacity calculator unit).

Claim 14 recites the limitation of three distinct charging/discharging current calculator units in lines 2-3(estimated, first, and second). There is insufficient antecedent basis for the limitation in the claim because claim 1 only discloses an estimated charging/discharging current calculator unit.

Claims 15, 16 and 17 are also rejected because they are dependent upon, and contain, the subject matter of claim 14.

Claim 19 recites the limitation "the first SOC estimator unit, the second SOC estimator unit, and the SOC estimator unit" in lines 304. There is insufficient antecedent basis for this limitation in the claim because claims 1 and 11, upon which this is dependent, only include two SOC estimator units, not three.

Claims 1-6, 9-11 and 18 stand rejected under 35 USC 102(b) as allegedly being anticipated by Watanabe (USP 6,258,163) ("Watanabe").

Claim 13 is rejected under 35 USC 103(a) as allegedly being unpatentable over Watanabe in view of Sakai (USP 6,608,482) ("Sakai").

The Applicant respectfully requests reconsideration of these rejections in view of the foregoing amendments and the following remarks.

## II. Claim Objections

Claims 1, 2, and 6 are amended to correct any perceived ambiguity.

## III. Claim Rejections, 35 USC, § 112, second paragraph

Claims 12, 14, and 19 are amended to correct any perceived ambiguity.

## IV. Pending Claims

Independent claims 1, 2, and 6, the only independent claims, stand rejected under 35 USC 102(b) as allegedly being anticipated by Watanabe.

The Applicant respectfully submits that claims 1, 2, and 6 are patentable over the cited references at least because they recite "...an SOC estimator unit which estimates a state of charge of the battery based on the estimated charging/discharging current which is determined by the estimated charging/discharging current calculator unit" and "...an open voltage calculator unit which sets the measured voltage of the battery as the open voltage of the battery at an initial calculation of the charging/discharging current and, after the initial calculation, calculates the open voltage of the battery based on the SOC which is previously estimated."

In contrast to Watanabe, which is commonly assigned to the Applicant, the Applicant's independent claims recite "an SOC estimator unit which estimates a state of charge SOC of the battery ***based on the estimated charging/discharging current*** determined by the estimated charging/discharging current calculator unit" and "an open voltage calculator unit which ***sets the measured voltage of the battery as the open voltage of the battery at an initial calculation of the charging/discharging current*** and, after the initial calculation, calculates the open voltage of the battery based on the SOC which is previously estimated." (emphasis added). The Applicant respectfully submits that these elements are neither taught nor suggested by Watanabe or any of the other cited references.

In certain embodiments of the present invention, and in contrast to Watanabe, the measured current value detected by the current detector unit is not used, but instead an internal resistance of a battery is estimated from a state of the battery. An estimated charging/discharging current of the battery is determined using the estimated internal resistance of the battery, the battery voltage, and the open voltage of battery calculated based on the state of charge ("SOC") which is previously estimated. Moreover, the state of charge of the battery is estimated based on the estimated charging/discharging current. Using this arrangement, the state of charge of the

battery can be precisely estimated without being affected by a measured current value, even when the measured current value detected by the current detector unit is a value containing an error or abnormal value. In addition, because the structure does not have a current detector unit which is expensive, it is possible to reduce the cost of the battery state-of charge estimator. The advantages of certain embodiments of the present invention are not realized by Watanabe.

Further to the above-noted distinctions, certain embodiments of the present invention realize an additional advantageous effect not provided by Watanabe in that, as shown in Fig. 3 of the present application, the estimated SOC which is estimated through integration of the estimated charging/discharging current value converges to the actual SOC as time elapses, and, therefore, there is an advantage that the precision of estimation of the SOC of the battery can be further improved.

More specifically, when the measured voltage is $V_m$, the internal resistance is R, and the open voltage is $V_{ocv}$, the following Equation (1) is satisfied:

Current I = $(V_m - V_{ocv,})/R$ (1)

When the real current value is $I_{real}$, the following Equation (2) is satisfied:

Real current value $I_{real} = (V_m\ V_{ocv\text{-}real})/R$ (2)

By determining the open voltage $V_{ocv}$ as described in Claims 1, 2, and 6 of the present application, the following Equation (3) is satisfied for a case when the estimated $V_{ocv}$ is greater than $V_{ocv\text{-}real}$ that is, when $V_{ocv\text{-}real} < V_{real}$

$(V_m - V_{ocv1})/R = 1_1 < I_{real}$ (3)

On the other hand, the following Equation (4) is satisfied when the estimated $V_{ocv}$ is smaller than $V_{ocv\text{-}real}$, that is, when $V_{ocv\text{-}real} > V_{ocv2}$..

$(V_m - V_{ocv2})/R = I_2 < I_{real}$ (4)

Therefore, when the "open voltage" of claims 1, 2, and 6 of the present application is used, as shown in Fig. 3, the charging/discharging current value $I_1$ is always estimated to be smaller than the actual current value $I_{real}$ when the estimated SOC is greater than the actual SOC and the current value $I_{real}$ is always estimated to be greater than the actual current value $I_{real}$ when

the estimated SOC is smaller than the actual SOC, also as shown in Fig. 3. Thus, as time elapses, the estimated SOC self-converges to the actual SOC and the SOC estimator of the present invention has an advantage that precision of the estimated SOC is improved.

Considering that electric vehicles and hybrid vehicles have become increasingly popular, and that there is a strong demand for more precisely knowing the state of charge of the battery equipped in such electrical vehicles and hybrid vehicles, the above-described advantages of the Applicant's claimed invention are significant.

Further, the Applicant respectfully submits that Sakai does not cure the deficiencies of Watanabe.

Therefore, the Applicant respectfully submits that, for at least these reasons, claims 1, 2, and 6, as well as their dependent claims, are patentable over the cited references.

## V. Conclusion

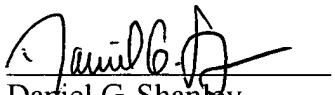
The Examiner is invited to contact the undersigned to discuss any issues related to the application. An early and favorable action on the merits is earnestly solicited.

Should there be any questions concerning this matter, the Examiner is invited to contact the Applicant's undersigned attorney.

The Commissioner is authorized to charge any fees or credit any overpayments which may be incurred in connection with this paper under 37 C.F.R. §§ 1.16 or 1.17 to Deposit Account No. 11-0600.

Respectfully submitted,

Dated: February 20, 2008

By: 

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